



TENNESSEE DEPARTMENT OF

EDUCATION
FIRST TO THE TOP

Agricultural and Biosystems Engineering

Primary Career Cluster:	Agriculture, Food and Natural Resources
Consultant:	Steven Gass, (615) 532-2847, Steven.Gass@tn.gov
Course Code(s):	5963
Prerequisite(s):	Agriscience (5957)
Credit:	1
Grade Level:	12
Graduation Requirements:	This course satisfies one of three credits required for an elective focus when taken in conjunction with other Agriculture courses.
Programs of Study and Sequence:	This is the fourth and final course in the <i>Agricultural Engineering and Applied Technologies</i> program of study.
Necessary Equipment:	Refer to the Teacher Resources page below.
Aligned Student Organization(s):	FFA: http://www.tnffa.org Allie Ellis, (615) 253-5207, Allie.Ellis@tn.gov
Supervised Agricultural Experience and/or Coordinating Work-Based Learning:	All Agriculture students are encouraged to participate in a Supervised Agricultural Experience (SAE) program. In addition, if a teacher has completed work-based learning training, he or she can offer appropriate placement. For more information, please visit http://www.tn.gov/education/cte/wb/ .
Available Student Industry Certifications:	None
Dual Credit or Dual Enrollment Opportunities:	There are currently dual credit opportunities with specific universities, including Tennessee Technological University (TTU).
Teacher Endorsement(s):	048, 448
Required Teacher Certifications/Training:	None
Teacher Resources:	http://www.tn.gov/education/cte/AgricultureFoodNaturalResources.shtml

Course Description

Agricultural and Biosystems Engineering is a capstone course that prepares students for further study or careers in engineering, environmental science, agricultural design and research, and agricultural mechanics. Special emphasis is given to the many modern applications of geographic information systems (GIS) and global positioning systems (GPS) to achieve various agricultural goals. Standards in this course are aligned with Tennessee Common Core State Standards for English Language Arts & Literacy in Technical Subjects, Tennessee Common Core State Standards for Mathematics, and National Agriculture, Food and Natural Resources Career Cluster Content Standards.*

Program of Study Application

This is the fourth and final course for the Agricultural Engineering and Applied Technologies program of study. For more information on the benefits and requirements of implementing this program in full, please visit the Agriculture, Food, and Natural Resources website at <http://www.tn.gov/education/cte/AgricultureFoodNaturalResources.shtml>.

Course Standards

Safety

- 1) Identify the benefits of knowing and applying basic safety procedures in both an agricultural laboratory and workplace. Interpret current Occupational Safety and Health Administration (OSHA) guidelines to conduct a compliance review of the agricultural laboratory, including a written summary justifying the findings with recommendations for improving the safety of working conditions. (TN CCSS Reading 1, 2; TN CCSS Writing 1, 4, 7, 9)
- 2) Review common laboratory safety procedures for tool and equipment operation in the agricultural and biosystems engineering laboratories, including but not limited to accident prevention and control procedures. Demonstrate the ability to follow safety and operational procedures in a lab setting and complete a safety test with 100 percent accuracy. (TN CCSS Reading 3)

Occupational Research and Awareness

- 3) Gather and analyze information from multiple authoritative sources such as the United States Bureau of Labor Statistics to develop a written projection of the occupational trends related to agricultural engineering. Supplement the narrative with relevant and properly cited charts, graphs, and other visual representations. (TN CCSS Reading 1, 9; TN CCSS Writing 2, 7, 9)

Project Planning and Management

- 4) Design a project plan for an agricultural engineering project, outlining a strategy for working within a given set of parameters, constraints, and resources. Include in the plan components related to the budget, timeline, safety considerations, and strategies to minimize adverse environmental impacts. (TN CCSS Writing 4, 9)

Geographic Information Systems, Precision Measurements, and Management

- 5) Synthesize case studies and field experience to provide evidence of the impact of geographic information systems (GIS) and global positioning systems (GPS) on agricultural demographics, precision agriculture, pasture management, water quality, watershed management, and waste pollution. Discuss the implications for industry and labor with the incorporation of these technologies into more and more facets of agricultural life. (TN CCSS Reading 1, 9; TN CCSS Writing 2, 7, 9)



- 6) Identify various GIS and GPS applications and explain their uses in precision agriculture, including but not limited to the following: precision agriculture management zones, crop water and drought areas, crop imaging, land correlation to crop yields, yield map cleaning and management, drainage analysis and tile mapping, crop data analysis, soil darkness mapping, suitability modeling, and slope angle and accuracy. (TN CCSS Writing 2, 7, 9; TN CCSS Math N-Q)
- 7) Demonstrate the ability to make land use, management, development, and equipment recommendations for a specific plot of land in rural and urban settings. Provide graphical and textual evidence to support each recommendation. (TN CCSS Reading 1, 3, 7; TN CCSS Writing 2, 7, 8, 9)

Geographic Information Systems, Irrigation, and Drainage

- 8) Analyze, map, and disseminate geographic information systems (GIS) and global positioning systems (GPS) data portraying a drainage map of a specified region. Citing specific evidence from findings, propose changes to drainage and irrigation systems and justify recommendations against accepted soil erosion control practices. (TN CCSS Reading 3, 9; TN CCSS Writing 1, 4, 6, 8, 9; TN CCSS Math N-Q, S-ID, S-IC)
- 9) Describe the relationships between concepts of hydrostatics, kinematics, and dynamics of fluid flows used for agricultural industry irrigation systems, including but not limited to pipes and open channels, using domain-specific language. (TN CCSS Reading 4, 5; TN CCSS Writing 9)

Structures: Environmental Impacts, Efficiency, and Certifications

- 10) Research agricultural buildings and facilities that meet industry benchmarks for energy efficiency and environmental sustainability. Collect observations on the costs and benefits of such structures and make recommendations to conserve energy and decrease operational cost, developing claim(s) with specific evidence from research. (TN CCSS Reading 1, 7; TN CCSS Writing 1, 7, 9)
- 11) Create a detailed construction plan for an agricultural facility suitable for a designated site, using natural systems and renewable energy where possible, and conserving energy and material resources in construction and maintenance while meeting building certification requirements. Include plans for recreating land or environments impacted by the construction (i.e., replacing displaced wetland with an artificial wetland). (TN CCSS Reading 3, 7; TN CCSS Writing 2, 7, 9)

Biophysical Properties of Crops and Food Products

- 12) Analyze the physical properties of selected agricultural crops and food products as they impact harvesting, storage, processing, and transport requirements, including but not limited to density, shape, moisture content, water potential, friction and flow of particulate solids, terminal velocity, thermal properties, and viscoelastic behavior of solids. Develop a fact sheet detailing the appropriate harvesting, storage, processing, and transportation equipment required for the range of crops and products analyzed, providing written justification for the use of chosen equipment. (TN CCSS Reading 1, 7, 8, 9; Writing 2, 8; TN CCSS Math N-Q, A-SSE, A-REI, G-C, G-GMD, G-MG)



Biochemistry of Agricultural Fertilizers and Chemicals

- 13) Develop a safety, storage, and disposal plan for agricultural chemicals such as pesticides, fertilizers, and veterinary medicines. Outline specific procedures pertaining to responsible selection and storage, mixing, transport, application, and disposal of waste, in compliance with applicable regulatory standards. (TN CCSS Reading 1, 3; TN CCSS Writing 2, 4, 8, 9)
- 14) Analyze the chemical and physical properties of selected agricultural fertilizers and chemicals in relation to specific crops and determine the most efficient and effective method of application. Demonstrate in a live setting or presentation the ability to calibrate equipment for liquid, solid, and gaseous applications. (TN CCSS Reading 3, 7, 9; TN CCSS Writing 2, 9)

Capstone Project

- 15) Participate in a team-driven agricultural engineering project approved by the instructor that includes research, planning, analysis, construction, testing, and evaluation phases to measure success and adherence to legal constraints. Prepare periodic oral and written reports to demonstrate progress. (TN CCSS Reading 1, 7, 9; TN CCSS Writing 2, 4, 8, 9)

Standards Alignment Notes

*References to other standards include:

- TN CCSS Reading: [Tennessee Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Reading Standards for Literacy in Science and Technical Subjects 6-12; Grades 11-12 Students (page 62).
 - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to demonstrate fluency in Standards 6, 8, and 10 at the conclusion of the course.
- TN CCSS Writing: [Tennessee Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 11-12; Grades 11-12 Students (pages 64-66).
 - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to demonstrate fluency in Standards 3, 5 and 10 at the conclusion of the course.
- TN CCSS Math: [Tennessee Common Core State Standards for Mathematics](#); Math Standards for High School: Number and Quantity, Algebra, Functions, Modeling, Geometry, Statistics and Probability (pages 58-83).
 - Note: The standards in this course are not meant to teach mathematical concepts. However, the concepts referenced above may provide teachers with opportunities to collaborate with mathematics educators to design project based activities or collaborate on lesson planning. Students who are engaging in activities listed above should be able to demonstrate quantitative, algebraic, functional, geometric, and statistical reasoning as applied to specific technical concepts. In addition, students will have the opportunity to practice the habits of mind as described in the eight Standards for Mathematical Practice.



- AFNR: [National Agriculture, Food and Natural Resources \(AFNR\) Career Cluster Content Standards](#). Students who are engaging in activities outlined above should be able to demonstrate fluency in Standards in CS, PST, ABS, NRS, PS, and ESS systems at the conclusion of the course.
- P21: Partnership for 21st Century Skills [Framework for 21st Century Learning](#)
 - Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.

